

**IN THE UNITED STATES DISTRICT COURT FOR THE
MIDDLE DISTRICT OF ALABAMA
MONTGOMERY DIVISION**

JEROME W. GRIFFIN, for himself,
and a class of African-American employees
of the Alabama Gas Corporation who within
the two (2) year statutory time limitation were
denied job promotions to non-bargaining unit
positions, the opportunity for such promotions,
and salary increases on account of race, regardless
of whether such employees are salaried, hourly,
union or non-union workers,

Plaintiffs,

v.

ALABAMA GAS CORPORATION, an
Alabama Corporation,

Defendant.

JURY DEMAND

Civil Action No.

2:06-CV-0365-MEF

AFFIDAVIT OF SUSAN CROMWELL DUNCAN

My name is Susan Cromwell Duncan. I have a PhD in Educational Psychology - Research, Measurement, and Statistics. My expertise is in the field of test construction which includes item bias, validity, and reliability; and survey design and statistical analyses. I am a senior research associate at Analytic Focus LLC. Attached to this affidavit is my curriculum vitae. The matters in this affidavit are based on my expertise and personal knowledge.

EXECUTIVE SUMMARY

I have two primary concerns with the claims made by Omega Consulting resulting from the work they conducted for Alabama Gas Corporation (ALAGASCO). These are the disproportionate representation of protected groups in the construction of their tests, the lack of testing for disparate impact and the lack of any measurement on the part of Omega Consulting to determine if the tests they developed could or did lead to any disparate impact or had the potential to do so. My conclusion is that Omega Consulting failed at every opportunity to test for any evidence of disparate impact in the supervisory test. No attempts were made to split the population into development \ test groups. No attempts were made to analyze the individual test items once the tests were given to ascertain if there were significant differences in patterns of response for minorities or women. This lack of effort to measure disparate impact is in violation of the *Uniform Guidelines* in section 4A "Each user should maintain and have available for inspection records or other information which will disclose the impact which its tests and other selection procedures have upon employment opportunities of persons by identifiable race, sex, or ethnic group as set forth in subparagraph B of this section in order to determine compliance with these guidelines."

While Omega Consulting claims that sample sizes were too small to measure any disparate impact, the fact is that there are a number of tests that could be applied to the data they had on hand to ascertain if a gross impact was present. *Principles for the Validation and Use of Personnel Selection Procedures* states "An approach to examining measurement bias in the domain of multi-item tests is to perform a differential item functioning (DIF) analysis," (p. 33) which, "refers to analyses that identify items for which members of different subgroups with identical total test scores (or identical estimated true scores in item response theory [IRT] models) have differing item performance." (p. 34).

Further, Omega Consulting precluded the possibility of some measurement procedures by not even attempting to measure the possibility of differing item performance among protected groups. The claims made by Omega Consulting regarding disparate impact measurement are not supportable since Omega made no effort to measure disparate impact or to design procedures that would allow them to do so. Once again, the *Principles for the Validation and Use of Personnel Selection Procedures* state, “Any claim of validity made for a selection procedure should be documented with appropriate research evidence built on the principles discussed in this document. Promotional literature or testimonial statements should not be used as evidence of validity.” (pg. 4).

The following sections describe how Omega conducted its research and where it could have provided information that would have been material to the claims of both the plaintiff and the defendant. I also provide support for the contention that a procedure for measurement of disparate impact could have been considered given the size of the group under review by Omega Consulting.

REVIEW OF OMEGA CONSULTING’S METHODS

I was given the Alabama Gas Corporation (ALAGASCO) Operations Supervisor Job Analysis and Test Validation Report (August 2005) to review the validation process used by Omega Consulting of the job analysis for the Operations Supervisor position. A summary of how the data was collected and who was selected to participate (samples) is important and this is explained in the report by Omega Consulting in the Methods section (pgs. 8-18). Omega Consulting defined five phases in their methodology section. The first four phases focus on data collection for the job analysis, and the fifth phase is titled “Technical Review.” The fifth phase is not a main focus because it is not explained in detail in the methodology section.

The first phase consisted of “Background research and technical advisory committee meetings” for Omega Consulting analysts (p. 9). Within this phase Omega Consulting reported that they obtained “suggestions regarding the scheduling of the project, recommendations for potential participants, and information other managers and he desired to capture with the job analysis.” (p. 9).

The second phase consisted of site observations of incumbents of Operations Supervisor positions by Omega Consulting to expose the Omega Consulting analysts to “a variety of assignments and provide a comprehensive picture of the Operations Supervisor’s position within

the organization.” (p. 9). The incumbents included fifteen employees that Omega Consulting and ALAGASCO supervisors deemed “a diverse group of incumbents.” This group of incumbents was made up of 80% (12) Caucasian males, 13% (2) African American males, 7% (1) Caucasian females, and 0 African American females (appendix A).

The third phase consisted of group interviews of incumbents of Operations Supervisor positions. The group interviews were “conducted to collect more detailed information concerning the work activities required of incumbents employed in the target classifications and to identify the knowledge, skills, and abilities necessary for the performance of those work activities,” and the goal of the group interview sessions “was to develop a comprehensive picture of the Operations Supervisor job.” (p. 10). The group of incumbents used for group interviews was 86% (12) Caucasian males, 14% (2) African American males, (0) Caucasian females, and (0) African American females (Appendix B).

The fourth phase involved the administration, data collection (responses to questionnaire), and data analysis of the Operations Supervisor JAQ. The participants that were administered the JAQ was also a group of ALAGASCO incumbents. This group consisted of 73% (24) Caucasian males, 21% (7) African American males, and 6% (2) Caucasian females.

POTENTIAL FOR DISPARATE IMPACT

Upon review of the ALAGASCO Operations Supervisor Job Analysis and Test Validation Report (August 2005), there are three main concerns:

- 1) disproportionate representation of race and gender in the samples used to collect data (appendix A, appendix B, and appendix D),
- 2) no attempt to use out of sample testing to determine if the test documents and procedures have any disparate impact, and
- 3) not exploring supplemental analyses within the content domain validity analyses to confirm/deny disparate impact by race or gender.

It is important to note, the data mentioned in all three main concerns is the “work behavior, task, KSA and PA lists resulting from the job analysis session.” (pgs. 13-14). This list is found in Appendix C.

The first main concern is disproportionate representation of race and gender in the samples used to collect data in the site observation individual interviews (Phase 2), group interviews (Phase 3), and JAQ administration (Phase 4). Phase 2, Phase 3, and Phase 4 have an

overrepresentation of Caucasians vs. African Americans and males vs. females. Disproportionate representation of groups within a sample can lead to possible item/test bias if the creation of a questionnaire is based on the overall responses from this type of unbalanced sample (phase 2, 3, and 4 samples) and the questionnaire is then used as criterion on the target population (candidates of Supervisor Operations position).

However, this is exactly what Omega Consulting reported on pages 13-14. The Job Analysis Questionnaire (JAQ) was created from the job analysis process in phases 2, 3, and 4 by using the “overall blueprint of the Operations Supervisor job content domain” (p. 13), which were the “work behavior, tasks, and abilities lists” (p. 13) resulting from the job analysis. The JAQ was constructed to address “the issue of essential job functions” and to “identify the elements of the domain that are most important and most frequently performed,” and “necessary at entry to the job.” (p. 14). Omega Consulting stated that “The data generated from administration of the questionnaire serve as a basis for selection procedure development. This data can additionally be used for various personnel functions such as job classification, job evaluation, or performance appraisal development.” Table 1 lists percentages for demographics for each phase.

Table 1: Proportional Distribution of Different Race and Gender Groups

	Individual Interview (Phase 2)	Group Interview (Phase 3)	JAQ Administration (Phase 4)
Caucasian Male	80%	86%	73%
African American Male	13%	14%	21%
Caucasian Female	7%	0%	6%
African American Female	0%	0%	0%

Participants within each phase were also selected to participate in two or more phases, which further exacerbated any disproportionate representation of race and gender in the data collected because their responses are not only recorded in one phase, but in multiple phases. In this case, if their responses are skewed in any way, the bias induced by this imbalance is multiplied across data collection phases. Table 2 lists the participants from each phase and their participation for each phase. Seven participants were included in phase 2, 3, and 4. One participant was included in phase 2 and phase 3. Seven participants were included in phase 2 and phase 4. Four participants were included in phase 3 and phase 4. In summary, if samples

contain unbalanced groups before data is collected, the possible bias due to unbalanced groups, measurement bias and sampling error will increase as the analysis progresses. In this case, due to reusing participants in each phase multiplies the possibility of measurement bias and sampling error.

Table 2 Participants involved in Data Collection Process.

Name	Individual Interview (Phase 2)	Group Interview (Phase 3)	JAQ Administration (Phase 4)
Wayne Burch	X		X
Sonny Dyson		X	X
Ricky Turner			X
Wallace Jones	X	X	X
Russell Harris			X
David Connel			X
Walter McCrimon	X	X	X
Jerry Carroll	X		X
Mitch Avery			X
Rick Moran			X
Lee Henderson			X
Darryl Garner	X		X
Jeff Gregory			X
Jeff Goodwyn		X	X
Nancy Hoyt			X
James Holloway	X		X
Dennis Sargent	X		X
Gary Welch			X
Robert Williams		X	X
Sam Glover			X
Bill Moffitt		X	X
Robert Nichols			X
Bud Rollan			X
Tommy Holcomb	X	X	X
Sam Monte	X	X	X
Wayne Sisk	X	X	X
Richard Stephens	X		X
Loretta Strange	X		X
Grady Hunter			X
Jerre Johnson	X	X	X
Jon Lauderdale	X	X	X
Jon Shiflett			X
Greg Williams			X
Jim Fike		X	
Karl Peterson	X	X	

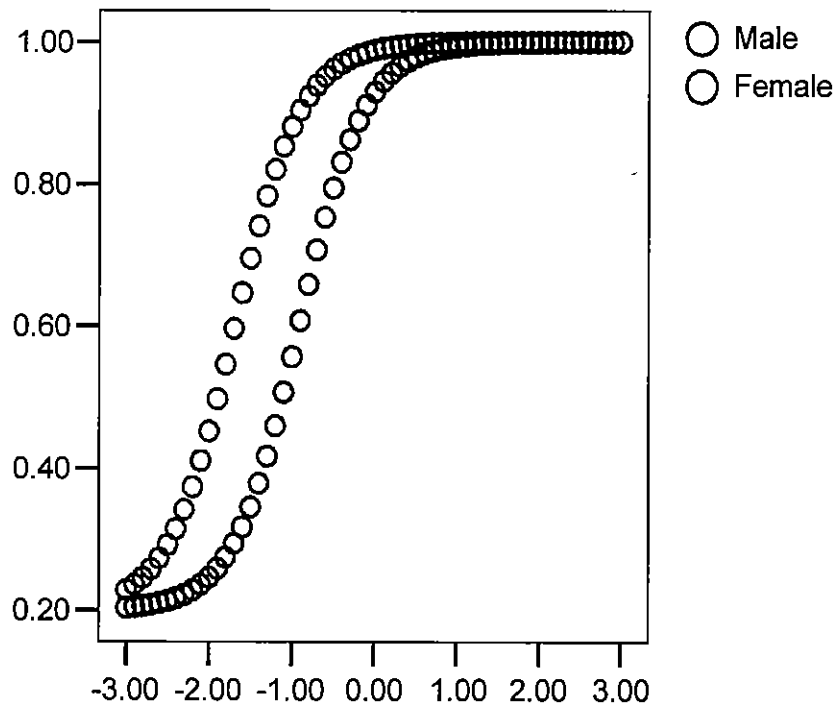
MEASUREMENT OF DISPARATE IMPACT IN TESTS CONDUCTED

The second main concern is that the job analysis report did not mention supplemental analyses on the original data collected in phases 2, 3, and 4 to confidently confirm/deny possible item bias (misrepresentation of race and/or gender) in the “overall blueprint” list of knowledge, tasks, and abilities or in the responses from the JAQ. A supplemental analysis of responses from the data collected in the test, controlling for race or gender, might give evidence to possible bias in the lists generated in phases 2, 3, and 4.

For the administration of the JAQ (phase 4) there were 24 Caucasian males, 7 African American males, and 2 Caucasian females. A common test design would sample 2 Caucasian males, 2 African American males, and the 2 Caucasian females. These individuals would be selected and all of their responses would be analyzed for similar or discrepant responses. Similarly, if the interest was between Caucasian and African American males, one might select 7 Caucasian males from the total of 24 and compare responses to the total 7 African American males’ responses. This type of balanced sampling design and supplemental analysis is common in experimental designs, and one way to compare across groups for possible item bias based on group differences such as race or gender (Scheaffer, Mendenhall, & Lyman, 1996). Information obtained in this supplemental analysis would be information otherwise unknown and helpful in level of confidence in possible item bias based on race or gender.

Another widely used analysis is Item Response Theory, which is designed to compare group differences per item (Embretson & Reise, 2000; Fan, 1998; Hambleton, Swaminathan, & Rogers, 1991). Group ability is compared across item responses; therefore the sample is made up of the items and then compared between two selected groups (subgroups). Item response theory is based on an item characteristic curve (ICC), which illustrates graphically the possibility of item bias between two subgroups. Figure 1 is an example of an ICC for a particular item comparing two subgroups’ overall ability on that particular item (Duncan, 2006). In Figure 1, the subgroups being compared across item ability is male vs. female; however, any pair of subgroups can be analyzed with IRT. The figure provides an illustration of a discrepancy between subgroups on this specific item suggesting females performed differently than males. Given this result, the item would then be further analyzed for revisions or deletion from the test.

Figure 1 Example of an ICC for Male vs. Female



In conclusion, Omega Consulting's job analysis and test validation report's conclusions of no disparate impact are not supported based on not performing any formal supplemental analyses or out of sample testing mentioned illustrated above. Omega Consulting's conclusions are not supported and inconclusive. In order to make the determination of no disparate impact a sampling design test and DIF analyses (Item Response Theory model) need to be implemented on the data collected from the job analysis process.

References

Duncan, Susan Cromwell. (2006). *Improving the Prediction of Differential Item Functioning: A Comparison of the Use of and Effect Size for Logistic Regression DIF and Mantel-Haenszel DIF Methods*. Doctoral dissertation, Texas A&M University, 2006.

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Embretson, S.E., & Reise, S.P. (2000). *Item response theory for psychologists*. Multivariate Applications Books Series. Mahwah, NJ: Lawrence Erlbaum Associates.

Fan, X. (1998). *Item Response Theory and classical test theory: an empirical comparison of their item/person statistics*. *Educational and Psychological Measurement*, 58, 357-381.

Hambleton, R. K., Swaminathan, H., & Rogers, H. J. (1991). *MMSS fundamentals of Item Response Theory*. Newbury Park, CA: Sage Publications.

Society for Industrial and Organizational Psychology, Inc. (2003). Principles for the validation and use of personnel selection procedures (4th ed.). College Park, MD: Author.

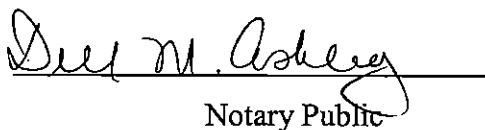
The foregoing affidavit consisting of 10 pages is true and correct to the best of my knowledge.



Susan Cromwell Duncan

ACKNOWLEDGMENT

SWORN TO AND SUBSCRIBED TO BEFORE ME, this 9th day of
October, 2006.



Notary Public

My commission expires: 10-22-07

Notary Seal

NOTARY PUBLIC STATE OF ALABAMA AT LARGE
MY COMMISSION EXPIRES: Oct 22, 2007
BONDED THRU NOTARY PUBLIC UNDERWRITERS



Susan Cromwell Duncan, Ph.D.
ANALYTIC FOCUS LLC

Key Qualifications

Susan C. Duncan is a Senior Research Associate at Analytic Focus LLC. Dr. Duncan's areas of expertise are in statistical research design in education and behavioral sciences. Dr. Duncan has also consulted in areas of litigation creating and developing surveys and databases and consulted in Biostatistics designing studies, analyzing, and interpreting data results.

Dr. Duncan has extensive experience in educational research through teaching research and statistics, conducting various research studies, and taking part in grant-funded projects at Texas A&M University. She has presented at educational conferences and been elected as a peer reviewer for the Southwest Educational Research Association Conference and the American Educational Research Association Conference. Dr. Duncan has also been a peer reviewer for the American Educational Research Journal. Dr. Duncan consults on research design, appropriate statistical analyses, and results interpretation.

Prior to Dr. Duncan joining Analytic Focus LLC, she consulted with professionals in education, litigation, and biostatistics on survey research design and statistical analyses.

Education

Ph.D., Educational Psychology – Research, Measurement, and Statistics, Texas A&M University, 2006
M.S., Clinical Psychology, Abilene Christian University, 1998
B.S., Psychology, Sam Houston State University, 1994

Professional Experience

Senior Research Associate, Analytic Focus LLC, 2006 to present.
Founder, Duncan Consulting LLC, November 2005 to September 2006.
Research Assistant, Texas Electric Coalition Project, Texas A&M University, 2003 – 2004.
Research Assistant, Center for Collaborative Learning Communities, Texas A&M University, 2002 – 2003.
Research Assistant, Department of Student Life Studies, Texas A&M University, 2000 – 2002.
Secondary Teacher, 8th Grade/7th Grade coach, Midland Independent School District, 1998 – 1999.

SUSAN CROMWELL DUNCAN

(Page 2)

Professional Associations

Adjunct Professor, Educational Research and Foundations of Research, University of Alabama - Birmingham, Spring and Summer 2006.

Adjunct Professor, Experimental Design I and Educational Statistics, Texas A&M University, 2002 - 2004.

Adjunct Professor, General Psychology, Jefferson State Community College, Spring and Summer 2000 and Fall 2006.

Adjunct Professor, Introductory to Psychology, Texas Women's University, 1999.

Professional Societies - Positions

Program Representative, Educational Psychology Foundations, 2002

Program Chair, Educational Research Exchange, 2002

Program Chair, Educational Research Exchange, 2003

Peer Reviewer, Southwest Educational Research Association Conference, 2002 and 2003

Peer Reviewer, American Educational Research Association Conference, 2002 and 2003

Peer Reviewer, American Educational Research Journal: Teaching, Learning, Human Development (AERJ:TLHD)

Professional Societies - Memberships

American Educational Research Association, 2001 - 2004

Southwest Educational Research Association, 2000 - 2004

American Psychological Association, 2000 - 2002

Southwest American Psychological Association, 1998

Publications

Schenarts P, Bowen J, Bard M, Segraves S, Toschlog E, Goettler C, Cromwell S, Rotondo M. (2006) *The effect of a rotating night-float coverage scheme on preventable and potentially preventable morbidity at a level 1 trauma center.* Am J Surg. 2005 Jul;190(1):147-52

Presentations and Conferences

Cromwell, S. *Item Response Theory and DIF Analyses: Software Package*, Southwest Educational Research Association, Dallas, February

J Bowen, MD, P Schenarts, MD, S C Duncan, MS, E Toschlog, MD, M Bard, MD, S Segraves, MD, C Goettler and M Rotondo, MD. *Does Resident Continuity of Care Matter? : The Effect of a Night-Float Coverage Scheme on Morbidity and Mortality at a Regional Level I Trauma Center.* Presented at the Resident Research Symposium, Department of Surgery, Brody School of Medicine, East Carolina University, June 2, 2004

J Johnson, MD, R Mageau, MD, S C Duncan, MS, N L Jenkins, MD, J Bowen, MD, Y S

SUSAN CROMWELL DUNCAN

(Page 3)

Sun, MD, J S Roth, MD W Nifong, MD, W R Chitwood, MD, FACS, FRCS. *Acute Intestinal Ischemia Associated with Stapled Intestinal Anastomoses Reinforced by Lemberts' Sutures or Nitinol Clips*. Presented at the Resident Research Symposium, Department of Surgery, Brody School of Medicine, East Carolina University, June 2, 2004

Cromwell, S. *Effect Sizes: Reporting Them Didn't Come out of Thin Air*, Southwest Educational Research Association, San Antonio, February

Cromwell, S., & McNamara, J. *Demystifying Types I, II, and III Sums of Squares*, Southwest Educational Research Association, San Antonio, February

Cromwell, S. *A Primer on Ways to Explore Item Bias*, Southwest Educational Research Association, Austin, February

Cromwell, S. *Applying the Bootstrap to Multivariate Analyses through Various Software*, American Educational Research Association, New Orleans, March.

Cromwell, S., & Castillo, L. *Effects of Acculturation on Retention in Minority Students in an Academic Setting*, Vancouver, Canadian Psychological Association

Cromwell, S. *An Introductory Summary of Various Effect Size Choices*, Southwest Educational Research Association, New Orleans, February

Cromwell, S., Weber, D., & Lawson, D. *Intimate Violence vs. Non-Intimate Violence Profiles*, Texas Psychological Association Conference, Austin, Texas
